Sustainability considerations in early phases of product development – the wood-based diaper

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1. The WooDi project

Today's modern diaper, both the baby diaper and the incontinence product, has had a very positive development during the last 20 years. The product has developed into a thinner, drier and more comfortable product to wear. One important feature is the development of the highly absorbent core, which was made possible by the introduction of the superabsorbent polymer (SAP). SAP is oil based as some other materials in the diaper like nonwovens, plastic film, adhesives and elastics. Since oil is a non-renewable resource which increases in price due to diminishing reserves, there is a wish for finding alternative materials. The forest industry desires to increase its competitiveness by enhancing the value of wood as a resource by refining the properties of e.g. wood fibre products. However, a change from a non-renewable to a renewable material does not guarantee a more sustainable product.

WooDi, the Wood based Diaper, is a research collaboration between industry and university. The research has a specific focus on replacing non-renewable materials in the absorbent structure of the diaper, while ensuring that the new diaper is also more sustainable than the reference diaper. The work packages in the project focus on forming networks of fibres with tailored properties, characterization of the networks, designing the production process, and assessing sustainability of the life-cycle of the diapers and guiding the material and product development process through important sustainability considerations.

A well functioning communication between different stakeholders in the project and a project group with knowledge from different areas will ensure that innovative ideas based on best available knowledge can be created and developed in consideration of relevant sustainability aspects. Important sustainability considerations therefore have to be visualised at the start of the project and thereafter repeatedly refined. After this first year of the project, many important choices still have to be made that will influence the sustainability performance of the diaper. For the new wood fibre based material that is being developed for the absorbent structure of the diaper, it is still not known what the properties of the new material will be, how it will be used in the diaper, how it will be produced and how it can be disposed of after use. There is thus an excellent opportunity to influence the process towards a more sustainable diaper. However, this calls for an iterative methodology for sustainability assessment that can guide the project through the development with an increasing level of accuracy and detail over time. Today, no such methods applicable to this project are available.

2. Sustainability assessment

To perform a sustainability assessment of a product, an overview of all the stakeholders' needs along the product's entire life cycle is needed (from raw material extraction via material production and product manufacturing to use and waste management, Figure 1). Thereafter, important sustainability aspects need to be defined and as far as possible quantified for the different phases in the life cycle. Examples of stakeholders are user, carer, supplier, seller, media, government, producer, resource owner, purchaser and more.

The goal is to develop a more sustainable diaper than today's diaper, and a thorough understanding of the whole system is then needed. Changes could results in that one phase of the life cycle in the new diaper becomes less sustainable e.g. the production phase, although the total sum of the five phases still shows that the new diaper is more sustainable than today's diaper. A new material seldom has the

exact same properties as the one it is to replace and can therefore not be exchanged without changes in the surrounding system, which will likely affect the sustainability performance of the system, sometimes even in remote parts.

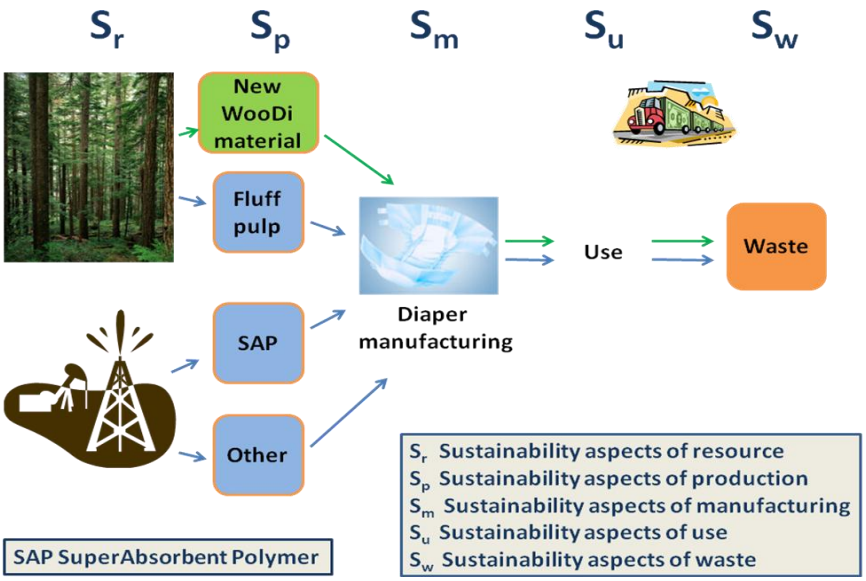

Figure 1: Overview of the life cycle phases included in the sustainability assessment of the diaper

Currently, one great concern in the WooDi project is how the limited land area should be used and how biological productivity can be maintained. In the LCA community, the assessment and evaluation of land-use for resource supply and other activities is being discussed. Effort is put into incorporating land-use impact into LCA as e.g. indicators for biodiversity and soil quality [1]. Also, social consequences of land-use, for example how to value e.g. the recreational and cultural values in the forest, are being discussed [2]. In the WooDi project, large emphasis will be put on defining relevant sustainability aspects and criteria related to land-use. Some useful components will likely be provided by the tool ToSIA, developed within Eforwood, an EU financed project, which aims to develop a decision support tool for sustainability impact assessment of the European forestry wood chains [3]. In the WooDi project, an important consideration will be how to assess and compare the use of non-renewable resources with renewable resources from the forest.

3. Conclusions

Moving towards a more sustainable diaper requires a balance of social, environmental and economic considerations throughout the development of the diaper and the materials constituting the diaper. This demands an ongoing communication of relevant sustainability aspects among all involved in the project. In the WooDi project, special emphasis is put on assessing the impact of changing from non-renewable to renewable resources.

4. References

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